International Water Management Institute

Irrigated Vegetable Production Interventions in Humanitarian Emergencies:

Ethiopia Country Deep Dive

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International Water Management Institute (IWMI)

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Cover photo: A farmer preparing waterways in a vegetable farm in Ethiopia (***photo***: Maheder Haileselassie / IWMI)

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Summary

Ethiopia is grappling with escalating humanitarian crises, including conflict-induced displacement and climate-related emergencies, and therefore mounting humanitarian needs. However, amidst these challenges, there is hope in the form of irrigated vegetable production (IVP) interventions, which have the potential to significantly decrease household vulnerability and build resilience to future shocks and stresses. Most importantly, these interventions aim to empower households by helping them generate additional income and improve their nutrition.

For this study, 20 key informant interviews were conducted with humanitarian organizations in Ethiopia to understand how they design and implement IVP interventions during emergencies. Data from these interviews were combined with insights from secondary sources, including journal articles and project reports, to identify critical challenges and opportunities for IVP in Ethiopia.

Key recommendations from this study include improving design and implementation of IVP interventions by humanitarian organizations. The recommendations are aligned with the Standards for Establishing Seed Systems in Disaster Settings (SEADS) minimum standards and complement SEADS guidance on tools, equipment, and other non-seed inputs and advice on impact monitoring and evaluation.

First, it is necessary that IVP design, planning, and implementation are contextually relevant. This involves aligning interventions with the preferences and needs of beneficiaries by conducting comprehensive assessments of their vulnerabilities and tailoring interventions to the dynamics of the food, land, and water systems affected by emergencies. Gender inclusion is also highlighted in the recommendations, with a focus on understanding the household- and community-level gender dynamics that play a role in selection of crops and technologies.

Second, mobilization of resources and investments to address funding shortages is important. This entails leveraging existing market structures, partnering with private sector entities, and collaborating with research institutions and government agencies. Inclusive financial mechanisms are recommended to support the more vulnerable households.

Third, it is imperative to strengthen organizational capacity for resilience and long-term learning. This includes building comprehensive needs analysis capacity, implementing holistic IVP interventions, and influencing the enabling environment. Developing intra-organizational learning and strong monitoring and evaluation systems is also suggested.

Lastly, organizational learning should be improved through data and knowledge management. This involves integrating data from multiple sources into a single platform, ensuring quick and easy access to it, and establishing robust reporting systems. The formation of a community of practice (CoP) focused on IVP in Ethiopia is proposed as a mechanism for knowledge sharing, capacity building, research collaboration, and policy alignment.

These recommendations offer a roadmap for humanitarian organizations, donors, and policymakers aiming to enhance the effectiveness and sustainability of IVP interventions in emergency contexts within Ethiopia. They also provide a framework for engaging with existing policies and governance structures and creating an enabling environment for effective intervention.

A man working on an onion farm in Ethiopia (*photo:* Maheder Haileslassie/IWMI).

Emergency Context and Humanitarian Needs in Ethiopia

Ethiopia is a disaster-prone country with approximately 12 million of its inhabitants regularly exposed to various shocks and stresses (Box 1). In global risk assessments, the country ranks high on susceptibility to disasters and low on adaptive and institutional capacities. It grapples with rapid-onset crises such as flash floods, landslides, and earthquakes, as well as slow-onset crises such as droughts and epidemics (Gilligan et al. 2011). Most humanitarian emergencies in Ethiopia are exacerbated by its underlying vulnerabilities due to underdevelopment, poverty, overpopulation, human-caused environmental degradation, and climate change. Land degradation, particularly in the northeastern, southcentral, and eastern highlands, contributes to and compounds the effects of these crises. Recently, the combination of brutal and escalating internal conflict, climate shocks, human rights abuses, disease outbreaks, and the socioeconomic impacts of the COVID-19 pandemic has led to the deterioration of humanitarian conditions and the emergence of complex crises in several parts of Ethiopia (HRW 2022). These crises have had severe repercussions including forced internal displacement, asset and livelihood destruction, and extreme poverty (Berhanu et al. 2007; Tilaye 2010; Hussein and Janekarnkij 2013; Ahmed 2019).

Box 1. Shocks and stresses contributing to Ethiopia's emergencies.

Climate and environmental crises. Ethiopia is especially vulnerable to drought emergencies due to its high dependence on increasingly unreliable rainfall patterns. The drought cycle which historically used to last around 10 years now occurs every 3-5 years, and is often followed by flooding in the main river basins (Enenkel et al. 2016). The unprecedented drought of 2020-2023 in the southern and southeastern pastoral zones, with six consecutive failed rainy seasons, was the worst in recent decades. Even though changes in the rainfall pattern due to climate change have been relatively modest, they are predicted to have major detrimental impacts on agricultural production. In March 2023, flash floods triggered by heavy rains killed dozens of people and affected hundreds of thousands in the very regions that had experienced extreme drought (NASA 2023).

Conflict and insecurity. Recent violence and insecurity have compounded the climate and environmental emergencies, leading to the formation of complex crises in regions such as Tigray, Oromia, Afar, and Benishangul-Gumuz. The Tigray conflict caused extensive civilian casualties, population displacement, and destruction of critical infrastructure. Widespread looting and destruction of crops and livestock left most households in the region without essential resources such as food, seeds, oxen, and farming inputs. This led to a comprehensive disintegration of Tigray's agricultural sector. By June 2022, 89 percent of households in Tigray were classified as food insecure and 47 percent as severely food insecure (WFP 2022).

Geographical disparities and poverty. The complex agroecology of Ethiopia results in geographical disparities with people across the country experiencing varying levels of vulnerability to emergencies and food insecurity. The poverty rate escalates by 7 percent for every additional 10 km distance from a market town of at least 50,000 people, indicating that rural households more distant from towns are less likely to access essential agricultural inputs and more prone to food insecurity. Particularly vulnerable are pastoralist areas such as the Somali and Afar regions as well as parts of the Oromia region due to poor infrastructure and market inaccessibility (Mohamed 2017).

Low agricultural productivity and food insecurity. Rapid population growth and low agricultural productivity have intensified pressure on land and water resources. Several regions of Ethiopia are grappling with shrinking landholdings, overgrazing, unsustainable cultivation practices, and land resource mismanagement. Low levels of productivity lead to limited earnings for farmers and high prices for consumers, exacerbating food insecurity. Prolonged experience of food insecurity constrains people's access to adequate, safe, and nutritious food, affecting their ability to lead an active and healthy life (Gilligan et al. 2011; Haile et al. 2021).

Food price inflation and supply chain shocks. The effects of these emergencies have been compounded by elevated levels of food insecurity and indebtedness due to the impact of the COVID-19 pandemic on supply chains and rising food prices due to, in part, the war in Ukraine (IRC 2023). Ethiopia's inflation rate for food prices, particularly cereals, ranks among the highest in Sub-Saharan Africa, having reached 37.7 percent in May 2022. Inflation disproportionately affects the rural poor because they are forced to allocate a larger share of their income to food (Mohamed 2017; IRC 2023).

Given this emergency context and the underlying systemic vulnerabilities, Ethiopia's population suffers from high levels of food insecurity. Humanitarian emergencies often occur in areas that are already grappling with pervasive poverty and high chronic and acute food insecurity, particularly in rural communities (Mohamed 2017). Even while agriculture employs 80 percent of the population, approximately 10 percent of the Ethiopian people experience chronic food insecurity, which escalates to over 15 percent during periods of drought (FEWS NET 2023). In July 2022, some 25.9 million people needed humanitarian assistance, and the country was on the brink of famine. Treatment for severe acute malnutrition was required for hundreds of thousands of children (CARE 2014; UNICEF 2024) (Figure 1). The magnitude of food assistance needed reached an unparalleled level for the second consecutive year in 2023. The protracted nature and the severity of conflict and drought in Ethiopia have rendered a substantial portion of the populace bereft of the assets required for food production or acquisition (FEWS NET 2023).

These crises disproportionately affect vulnerable populations, including landless laborers, women, children, the elderly, and displaced persons. These groups often are marginalized due to various factors such as poverty, lack of access to resources, and social inequality, and Ethiopia's emergency context exacerbates their vulnerability. For example, crises often lead to increased violence against women and girls (Irenso and Atomsa 2018; Bahru et al. 2020).

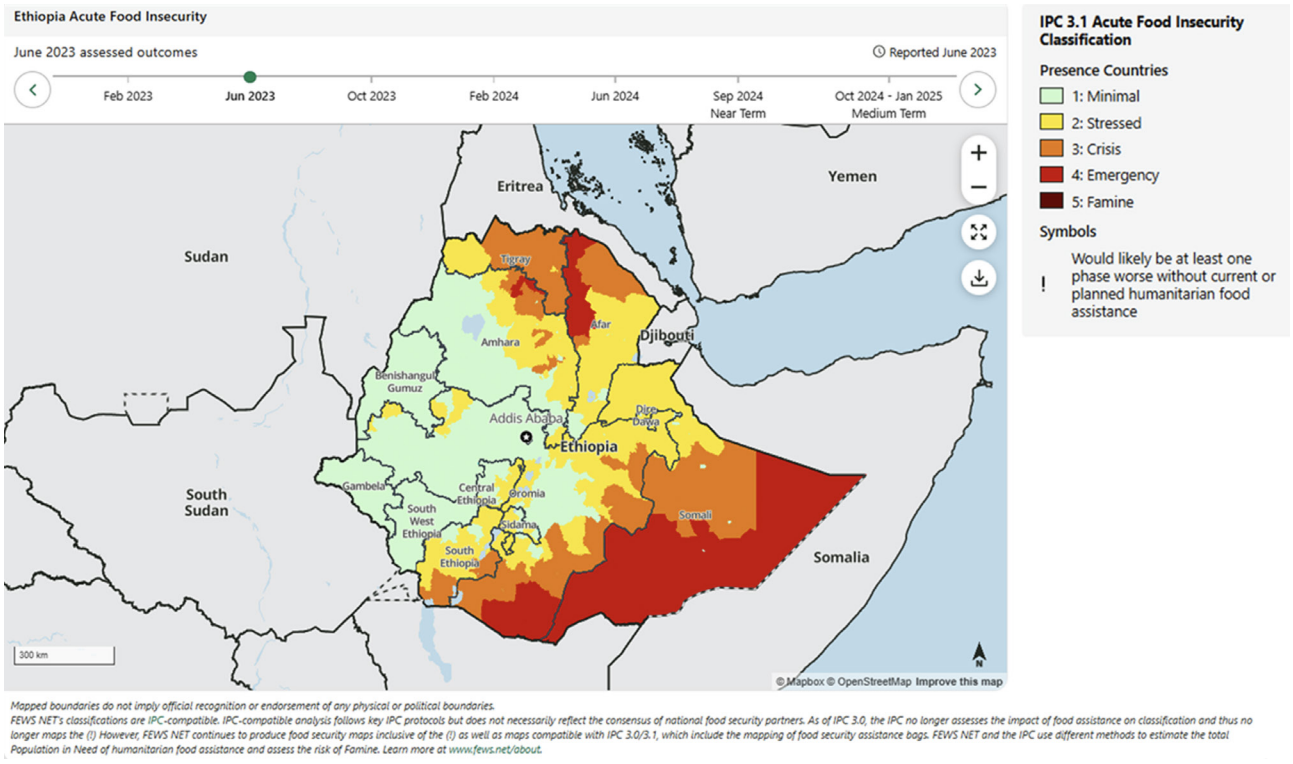

Figure 1. Food insecurity map of Ethiopia, July 2023.
Source: FEWS NET 2023.

Humanitarian Response to Escalating Food Insecurity Crises

The Ethiopian government has responded to the high number of emergencies and escalating food insecurity crises (Box 2) by implementing a range of health, water, food distribution, and agriculture-related interventions (Moss et al. 2018). However, results from humanitarian interventions have been mixed for several reasons:

- **The government's capacity to implement humanitarian emergency assistance is limited** (Asefa and Zegeye 2012; Ahmed 2019). For example, the Productive Safety Net Program (PSNP) has not significantly improved the situation regarding household food insecurity or undernutrition among women and children (Irenso and Atomsa 2018; Bahru et al. 2020). Much of the population lacked access to PSNP support even during periods of high food insecurity (Asefa and Zegeye 2012; Ahmed 2019).

- **Funding for humanitarian programs consistently falls short of needs.** Due to the sheer scale of the population left food insecure in Ethiopia, it is beyond the resources or capacity available for humanitarian assistance to respond adequately. Ethiopia's drought response required USD 1.66 billion, but by the end of 2022, only 42 percent of the need was funded; an appeal by the United Nations Children's Fund (UNICEF) for assistance for children's needs was only 38 percent fulfilled (IRC 2023). Due to these funding shortfalls, emergency policies and plans tend to neglect specific populations, such as older adults.

- **Humanitarian organizations are often unable to reach areas of need.** In Tigray, for example, misappropriation of food assistance led to WFP and USAID withdrawing aid until supply chains were reconfigured. Safety concerns in conflict-affected areas have hampered the ability of humanitarian organizations to reach crisis-affected communities with critical support (USAID 2023).

Box 2. Humanitarian response programs in Ethiopia.

- **Government-led programs**
  - The Productive Safety Net Program (PSNP), one of the largest social protection programs in Sub-Saharan Africa, aims to improve the food security of chronically food-insecure households through direct grants and labor-intensive public works (Mohamed 2017; Abay et al. 2022).
- **International organization-led programs**
  - The World Food Programme (WFP) has initiated various interventions in response to emergencies and the resulting food and water insecurity (WFP 2022).
  - The UN Refugee Agency (UNHCR) provides aid to refugees, asylum seekers, and internally displaced persons (UNHCR 2023).
  - The Ethiopian Red Cross Society (ERCS) addresses the needs of vulnerable populations in the country and helps build resilience (ERCS 2023).
  - The United States Agency for International Development (USAID) helps the Ethiopian government anticipate, plan for, mitigate, and respond to disasters and strengthen disaster risk management capabilities (USAID 2023).

Humanitarian organizations direct their efforts toward providing relief and helping beneficiaries build self-reliance[1] by engaging in positive coping strategies. This can help limit dependence on humanitarian relief and protect households and communities from the vagaries of global supply chains, changes in donor funding, or obstruction of humanitarian access (Seff et al. 2021).

[1] Self-reliance is the 'social and economic ability of an individual, a household or a community to meet (their) essential needs in a sustainable manner and with dignity' (UNHCR 2023).

Households engage in various coping strategies to deal with food insecurity when there is an inadequate safety net or humanitarian relief. These coping strategies include livestock sale, agricultural employment, migration, minimized food frequency, and going without food for extended periods. While some coping strategies can increase vulnerability in the long run, others contribute to decreased vulnerability (Melese et al. 2021).

Irrigation is an effective coping strategy for improving household food security and building long-term resilience to shocks and stresses (Box 3). Irrigation results in higher production and yield, reduced risk of crop failure, diversified cropping patterns, annual household farm income, and asset holdings (Tekeste et al. 2011; Mohamed 2017; Legesse et al. 2018). It allows farmers to switch from self-reliant farming to high-value, market-oriented production, secures food at lower prices for urban consumers, and generates foreign exchange (MoA 2011; Ahmed 2019). Irrigated vegetable production has been found to positively affect household nutrition and dietary diversity, reduce the prevalence of anemia, and elevate levels of energy and calcium intake among women.

Box 3. Irrigation development in Ethiopia.

The government of Ethiopia recognizes irrigation development as fundamental for improving food security. Most crop production in Ethiopia is small-scale and reliant on rainfed agriculture with only 4-5 percent of the cultivated area irrigated as of 2010 (MoA 2011; Ahmed 2019). Smallholder farms, most of them less than 1 ha in size, account for only 1.3 percent of the total irrigation area (Sheahan and Barrett 2017). Access to irrigation can help households intensify production and maximize the potential of their limited land resources (Bezu and Holden 2014). The government has outlined ambitious irrigation development strategies in its successive five-year plans, aiming to extend land under small-scale irrigation to 11 million ha.

The government and its development partners provide technical and financial support to help smallholder farmers adopt irrigation technologies, systems, and practices (MoFED 2013; Ahmed 2019). Many interventions focus on developing irrigation systems for vegetable production. Given the potential for greater financial returns, IVP is a significant income-generating activity for thousands of smallholder farmers. Irrigation investments focus on high-value horticultural crops to help create livelihood opportunities for farmers and to support local economic development. In emergency contexts, IVP interventions also aim at improving the nutritional status of families and enabling households to draw on another source of income (Awulachew et al. 2010; Demese et al. 2010; World Bank 2015a; FDRE 2016).

Despite the huge interest, irrigation development tends to benefit wealthier households, and its impact remains limited due to underdeveloped value chains. Irrigation expansion is challenged by limited technology uptake and underdeveloped value chains in remote rural areas (Passarelli et al. 2018; Bryan et al. 2020). Farmer-led irrigation development (FLID), in which farmers take the lead in investing and developing irrigation facilities, has primarily benefited wealthier households that have access to land and water resources and the financial capacity to purchase irrigation technologies. On the other hand, vulnerable rural households that are most exposed to shocks and stresses face the highest barriers to having irrigation.

The most vulnerable resource-poor households lack market connectivity, access to land and water, and the financial capacity to invest (Kafle et al. 2022). Vulnerable households are usually those below the poverty line and at higher risk of facing food and water insecurity. Low levels of technology adoption, lack of awareness or knowledge, inadequate marketing services, and poor rural infrastructure contribute to high levels of vulnerability and low agricultural productivity and livelihood resilience. These factors limit farmers' earnings and contribute to high prices for consumers. Within households, women, children, and the elderly may be more vulnerable to food and water insecurity (ATA 2010; Woldeamanuel 2009; World Bank 2015b; Ahmed 2019).

Current Design and Implementation of Irrigated Vegetable Production Interventions

The International Water Management Institute (IWMI) has established a significant presence in Ethiopia with its East Africa and Nile Basin Office in Addis Ababa. This office is part of the CGIAR campus and collaborates closely with other CGIAR centers on various global research-for-development programs. Its staff of 27 members, including eight national positions, specialize in scientific leadership, technical support, knowledge management, and communication. The institute has been actively engaged in Ethiopia for over ten years. It partners with governments, civil society, and the private sector to develop scalable agricultural water management solutions. IWMI collaborates with an array of stakeholders, from rural farmers to national policymakers. Regarding partners, IWMI has established relationships with Ethiopian institutions such as Addis Ababa University, Amhara Regional Agricultural Research Institute, Ministry of Agriculture, and Ministry of Water and Energy. These partnerships enable IWMI to undertake research tailored to local solutions and generate timely policy advice. It is a think tank, a science-based products and tools provider, and a learning and capacity-strengthening facilitator.

In Ethiopia, IWMI's research focuses on several critical areas, including remote sensing and mapping, water storage, improving agricultural water management (AWM), enhancing smallholder incomes, climate change and adaptation, and landscapes and ecosystems for resilient rural livelihoods. Specifically, IWMI's research aims to raise crop yields through smallholder irrigation development. The institute has provided policymakers, farmers, and development practitioners with recommendations to improve access to investment in irrigation equipment, borehole drilling, and motorized water pumps. Furthermore, IWMI has developed detailed maps that define areas that are most responsive to specific AWM practices. By providing science-based insights and tools, IWMI creates an enabling environment for developing and scaling effective water management practices, particularly in smallholder irrigation (IWMI 2021).

In a recent literature review, IWMI found that little is known about how humanitarian organizations design and implement IVP interventions and the implications that has for food security and resilience (Singh et al., forthcoming). This is due to two reasons. First, humanitarian initiatives mostly focus on providing immediate relief rather than supporting agricultural activities. Promoting IVP during emergencies is a recent development; moreover, when agricultural support does take place, it tends to focus on staple crops rather than IVP (see SEADS 2022). Second, data on how humanitarian organizations design and implement IVP interventions has not been systematically collected and analyzed (Singh et al., forthcoming).

To fill this gap, IWMI conducted 20 in-depth, semi-structured interviews with project managers and officers working in the humanitarian sector who were experienced in implementing interventions, including vegetable production with or without irrigation in Mali, between May and July 2023. The questions asked in the interviews included the type of IVP support provided by the project, the objectives of the intervention, the project components, the type of crises, the type of beneficiaries, etc. Based on data analysis, the following sections present the findings on current IVP intervention design and implementation.

Goals and Beneficiaries

Humanitarian organizations carry out IVP interventions during emergencies to improve household food security, livelihoods, and nutrition. Some interventions aim to build long-term resilience at the household and community levels. Humanitarian organizations target livelihood improvement through climate-resilient and marketable vegetable production and consumption of nutritious vegetables, particularly by women and children. Most organizations assess outcomes solely in terms of increased vegetable production. Few efforts have been made to understand resilience outcomes at a systemic level (e.g., agrifood systems, ecological systems, sociotechnical systems).

Interventions are carried out in rural and urban areas and camps for refugees/internally displaced people (IDP). For most organizations, vulnerable populations include communities located in disaster-prone areas or specific members of households, such as pregnant women. Targeting of refugee communities occurs in collaboration with UN organizations and government agencies.

IVP interventions are carried out in response to slow-onset, rapid-onset, and complex crises. These crises include flooding, drought, conflict, and displacement emergencies. However, interventions as a response to pests (e.g., locusts) are rare. IVP interventions target resource-poor smallholders and vulnerable members of households affected by

crises. In slow-onset or complex crises, in which shocks and stresses are drawn out over a long time, development and humanitarian interventions overlap significantly and have similar IVP design and implementation approaches.

Often, government data are used to select beneficiaries in rural areas. Household data from the Ministry of Health and the Regional Disaster and Response Commission are often used to select the most vulnerable or impoverished households in a community. Such data are collected from the community and/or government agencies through key informant interviews, surveys, or focus group discussions to gauge the demand for and interest in IVP interventions. This sometimes involves a longer decision-making process that includes engagement with community leaders on which beneficiaries to include. and may require the intervention plan to be presented to the broader community for approval. Depending on the type of emergency, several organizations try to perform a participatory assessment of the type of intervention desired and needed. In rare cases, organizations make it obligatory for community members to join a financial lending institution before becoming a beneficiary of the intervention.

Intervention Design

IVP intervention design generally involves delivering input packages for vegetable production, financial support, and training. The input package includes nutrition-sensitive or climate-suitable vegetable seeds, farm tools, irrigation technologies, and training on technology operation, maintenance, and agricultural practices. Interventions often establish a model farm or demonstration plot where community leaders are actively engaged and new technologies or practices are shown to beneficiaries.

Vegetable selection and promotion are based on their marketability and anticipated nutritional outcomes. The most popular vegetables include tomatoes, cabbage, onions, leafy greens, and potatoes. Other commonly promoted vegetables include sweet potato, beetroot, and eggplant. In some cases, vegetable selection is aligned with ongoing government projects such as the Agricultural Commercial Clusters Initiative which defines specific commodity clusters across regions. Additional considerations for vegetable selection include environmental suitability, land size, and the experience and knowledge possessed by the targeted beneficiaries. Secondary data on vegetable suitability and production are rarely used. Value-chain assessment and cost-benefit analysis for different vegetables are often limited.

Most organizations provide training on vegetable production, irrigation technology use, and sustainable water management practices. This includes caring for crops during their different growth stages, appropriate soil and water management, prevention of pests and diseases, and using and maintaining the promoted water lifting and irrigation technologies. A few organizations train communities on water management principles and establish water users' associations (WUAs), especially when investing in irrigation infrastructure development (e.g., dams and canals).

Interventions at the community level sometimes establish a village-level association to manage water resources sustainably and equitably. These associations monitor water levels and use, resolve conflicts or disagreements during periods of water scarcity, and organize infrastructure maintenance. In rare cases, the upper catchment is included in the ambit of management interventions (e.g., reforestation projects) to ensure the sustainability of water resources.

Several humanitarian organizations develop financial institutions, such as savings cooperatives, or themselves provide loans to households through microfinance organizations. The aim is to support access to agricultural inputs (e.g., fertilizer, seeds), and assist households in sustaining innovation adoption. If the enabling environment allows households to generate a return on investment in IVP, credit and savings cooperatives are more likely to meet the members' needs in the long term.

Irrigation Intervention

Interventions include construction of irrigation infrastructure to increase access to ground and surface water. This may include building canals, reservoirs or dams, and water diversion structures where surface water resources are plentiful. Where there is insufficient surface water, interventions may develop groundwater resources by digging shallow wells or building rainwater harvesting structures. Gray water is rarely used or considered for irrigation.

Decisions on water lifting and application technologies are based on the selected vegetables, the existing water sources, and, in some cases, beneficiary experience. Water lifting and application technologies are promoted over

large irrigation scheme infrastructure, given their flexibility in IVP interventions using surface or groundwater resources. While solar-powered and diesel/petrol-powered pumps are both promoted for water lifting, solar-powered pumps are currently the more popular option. Treadles, rope and washer, and hand pumps have become less common. The most common water application technologies are jerrycans, watering cans, and buckets followed by drip irrigation kits. Micro-sprinklers are rarely promoted as a water application technology.

An urban farmer in the conflict-affected Oromia region of Ethiopia (*photo:* Desalegne Tegegne/IWMI).

In all cases, organizations pay for the technologies directly, without micro-credit or cooperative savings. The sourced technologies are often transported from Addis Ababa or imported from abroad. They are rarely available locally (except buckets, jerrycans, manual pumps, and sometimes diesel/petrol pumps). Hence, spare parts are often not available in the local markets. The level of beneficiary experience in using irrigation and promoted technologies varies across the intervention sites.

Humanitarian organizations do not always consider water resource availability and sustainability needs. When organizations conduct their baseline assessment, they often lack assessments on water availability and security, vegetable suitability, and the effects of a recent emergency. They depend on government data from the *woreda* (district) level or from the Ethiopia Meteorological Institute to determine the sustainability of primary water sources. The lack of data availability complicates these assessments. Organizations rarely consult indigenous knowledge for these assessments.

While interventions have an explicit gender component and target women beneficiaries, many organizations do not include the dimension of gendered technology preference and use in their interventions. Most organizations evaluate how technologies can reduce women's burden of fetching and carrying water or how IVP can provide women with another source of income. There is, however, limited evaluation of gendered preferences for various technologies, why women might prefer one technology over another, and how technology adoption can shape intra-household gender dynamics in ways that might be detrimental to women. For example, growing lucrative crops through irrigation might lead to men taking over ownership of production and earnings from sales.

Implementation and Partnerships

Partnerships for designing, implementing, and monitoring the outcomes of IVP interventions always include lower-level government structures [zones, *kebeles* (wards), *woredas*], NGOs, UN agencies, universities, research-for-development organizations, churches, and community groups. Humanitarian organizations rely upon governments to ensure that water is managed sustainably.

In most cases, the responsibility for monitoring and administration of water resource use and management is handed over to the government once an intervention is completed. Monitoring and evaluation are done at the household level to measure increases in production or income. However, regular follow-ups and a monitoring and evaluation system are rarely in place.

Private sector engagement and investment in interventions are limited. Banks or private sector companies are rarely involved in humanitarian interventions.

Opportunities in and Challenges to IVP Interventions

Based on an analysis of data collected from humanitarian organizations, Table 1 summarizes the opportunities and contextual and organizational challenges present in IVP interventions. These opportunities and challenges result in further unanticipated complexities for the operations of organizations. To grapple with these challenges and build on the opportunities available in the enabling environment, humanitarian organizations must have strong internal capacities to effectively design and implement interventions in emergency contexts.

Table 1. Overview of opportunities and challenges faced by IVP interventions.

Opportunities	Contextual challenges	Organizational challenges
Goals and beneficiaries		
• Substantial support for humanitarian organizations in targeting beneficiaries • Possible sourcing of agricultural inputs from local, national, or international markets • Increasing support for the horticultural sector	• Disjointed institutional approaches and shifts in government policy • Inaccurate household-level data leading to incorrect targeting of beneficiaries • Uncertain vegetable markets	• The dominant attitude of "any assistance is better than none" • Distraction from more viable livelihood opportunities • Overreliance on limited government data and minimal engagement with other knowledge sources
Intervention design		
• Potential increase of economic benefits for households as a result of value chain-based interventions	• Underdeveloped agricultural input and irrigation technology supply chains • Destabilization of fragile agricultural value chains by global, national, or regional shocks • Limited investment in sustained IVP production due to emergency context	• Increasing dependence on markets due to systemic vulnerabilities • Lack of systemic analyses in designing IVP interventions • Dominance of the "free-gift" approach
Irrigation intervention		
• High market prices for irrigated vegetables compared to staple crops • Vulnerable communities' familiarity with vegetable cultivation and consumption	• High inflation, unpredictable supply, and fluctuating market prices of irrigation technologies • Limited data for groundwater development for irrigation	• Inadequate attention given to the functioning of input markets for irrigation technologies • Limited attention paid to the innovation systems around irrigation technologies
Implementation and partnerships		
• A conducive policy environment for IVP interventions • Sufficient surface water and groundwater resources	• Limited funding to finance beneficiaries› investments in the long term • Limited interconnection, coordination, partnership, and collaboration • Limited access to data for humanitarian organizations	• Limited reflective and collaborative learning among humanitarian organizations • Insufficient attention paid to the potential effects of future emergencies on IPV interventions

Connecting hoses to pump groundwater for irrigation in Ethiopia (*photo:* Maheder Haileslassie/IWMI).

Opportunities for IVP Interventions

Goals and Beneficiaries

Local government agencies provide substantial support to humanitarian organizations in targeting beneficiaries. The government supports IVP interventions by helping to identify the relevant households and beneficiaries. Vulnerable households are identified on the basis of asset vulnerability (based on livelihood indicators), food gap analysis (the gap between food needs and consumption), experience of and exposure to shocks, and the ability to raise funds in times of need (World Bank 2015b). Such support in identifying vulnerable households ensures the geographic spread of interventions such that overlaps and redundancies are minimized and humanitarian funding is used to achieve maximum impact. Also, organizations have to work with the government to try to sustain project outcomes.

The familiarity most communities have with vegetable gardens and their routine purchase of vegetables from the market establishes a foundational understanding of and need for IVP. Many households have prior experience of growing a variety of vegetables consumed domestically and so are likely to be eager for support. Therefore, humanitarian organizations' approach of building resilience through investments in IVP is sound. However, in certain communities (such as refugee communities), the need for and acceptance of IVP might not always be the biggest priority.

Intervention Design

Vegetables get high market prices compared to staple crops, which makes IVP lucrative for many households. This can serve as an opportunity for livelihood diversification, nutrition improvement, and increased income. Furthermore, compared to staple crops, vegetables can be grown multiple times a year with irrigation, ensuring steady on-farm income. Economic benefits to households can increase if humanitarian organizations include value chain analysis when designing their IVP interventions and promoting vegetables and irrigation technologies.

Irrigation Intervention

National and regional development policies, especially smallholder irrigation development, provide a conducive environment for IVP. Given Ethiopia's development ideology, which seeks to promote irrigation among smallholder farmers, interventions in this sector are intrinsically political (Bryan et al. 2020; Gebreyes and Muller-Mahn 2019) by being in alignment with national and regional development policies, especially smallholder irrigation development. Humanitarian organizations can thus leverage the existing physical and institutional infrastructure to maximize the impact of their intervention.

Surface water and groundwater resources are sufficiently available to support IVP. Annual surface water flows in Ethiopia are generated from 12 transboundary rivers (Yimere and Assefa 2022), accounting for 40 billion cubic meters (BCM) (MoWIE 2021). Ethiopia's groundwater potential is also estimated to be substantial, though it is still underdeveloped. Access to these water resources would enable households to engage in IVP.

Implementation and Partnerships

Humanitarian organizations invest in inputs and can source them from local, national, or international markets. This is often enough to provide several types of technologies and seeds to beneficiaries and carry out training and capacity building for IVP. Financing is usually tied to donor commitments and project cycles. However, there is usually not enough funding to finance beneficiaries' investments in the long term.

Contextual Challenges

Goals and Beneficiaries

Unstable vegetable markets can increase beneficiaries' vulnerability, especially when impacts are highly localized. For example, unexpected market price drops have rendered some vegetable interventions ineffective at harvest. Beneficiaries lose time, labor, and, in some cases, their investment. The impact of external shocks on market price fluctuations might diminish trust in future interventions or attempts to promote IVP.

Targeting the right beneficiaries can be a challenge if accurate household-level data are not provided by government agencies. The data do not always include recent information on how emergencies have impacted households and their assets. This undermines the efficacy of the intervention and the likelihood of IVP adoption.

Intervention Design

Agricultural input and irrigation technology supply chains are weak and underdeveloped in rural areas. This increases the cost of imported irrigation technologies such as solar-powered irrigation pumps and drip kits and reduces the availability of maintenance services and spare parts.

Global, national, or regional-level shocks destabilize fragile agricultural value chains, complicating IVP market development. Crises such as the COVID-19 pandemic, the Tigrayan conflict, the war in Ukraine, and the drought in

2022 and 2023 exacerbated the functioning of these supply chains, leading to high inflation, unpredictable supply, and fluctuating market prices. Diesel became prohibitively expensive, making diesel-powered pump operations unaffordable to many farmers. The more stable and predictable value chains and market prices are, the more long-term investments can be made in IVP (Tirivanhu et al. 2022).

The emergency context circumscribes communities' access to input and output markets, limiting investment in sustained IVP production. Even if technologies and other inputs are available in local markets, conflict, instability, and other security challenges may mean that specific households cannot be assured of unhindered access. Regional discrepancies in conflict management approaches and challenges in multisector collaboration compound these complexities. Furthermore, technology theft presents an acute challenge, especially in compromised security settings. In such cases, beneficiaries are often unable to purchase replacements even if inclined to do so (Jaspars and Maxwell 2009).

Irrigation Intervention

Significant gaps in data on water resources, especially groundwater, challenge the design, long-term planning, and management of interventions. Despite the investments made in data infrastructure in relevant ministries, the available data (especially concerning groundwater) lack the granularity required for planning. Furthermore, the data are not always available to humanitarian organizations at a sufficiently high temporal and spatial resolution. Hence, groundwater development for irrigation purposes is highly risky as households can run out of water, and shallow groundwater is highly susceptible to rainfall seasons and drought. Furthermore, there is no accessible system that reports on changes in water availability due to climatic changes and increasing demand across sectors. This complicates the planning of interventions, especially after rapid-onset disasters such as floods or slow-onset disasters such as droughts.

Implementation and Partnerships

Disjointed institutional approaches and shifts in government policy create difficulties in long-term planning. The institutional support that local governments can provide is often inadequate for sustaining the outcomes of an intervention. This is exacerbated by the absence of a national database and emergency-related information-sharing platform that delivers information to local levels of government. Limited interconnection, coordination, partnership, and collaboration among humanitarian organizations and other stakeholders hinder the leveraging of synergies and investment.

Organizational Challenges

Goals and Beneficiaries

Prioritizing IVP over other pathways of livelihood diversification may limit engagement in other, more sustainable, livelihood strategies. At the household level, the labor requirement for adopting specific technologies can lead to an increase in gendered workloads, negatively impacting women (Theis et al. 2018). Similarly, households' investment of time and labor in IVP may detract from other livelihood opportunities that are more viable to them in the long run. A lack of interest in participating in IVP interventions has been particularly noted among refugee populations. Furthermore, the option of cultivating "undesirable", yet more profitable, crops, e.g., *khat* (*Catha edulis*, Bushman's tea), poses another challenge to IVP adoption.

Vulnerable populations tend to have limited ownership over interventions because irrigation technologies are often provided to beneficiaries free of charge. Such an approach diminishes the likelihood of beneficiaries investing in maintenance and continued use of the technology, especially when challenges arise. Communities often fail to meet agreed-upon cost-sharing requirements, leading to a diminished sense of ownership over intervention outcomes. Donor dependency is a significant impediment to the success of IVP interventions.

Intervention Design

The most vulnerable members in an affected community often lack access to the natural, physical, and otherwise essential assets that might enable them to sustain investments in IVP. They are often situated far from markets or essential infrastructure. Distributing inputs as part of an emergency response can undermine local input value chains and introduce dependence on a specific type of input that may not reliably be available to them in the long term (Jaspars and Maxwell 2009; Sperling 2022). A shift toward market-oriented vegetable production can increase dependence on market dynamics, elevating household exposure to price fluctuations and supply chain shocks, both global and local.

Paying inadequate attention to the functioning of input markets limits a household's capacity to sustain production and benefit from IVP. Promoting technologies that are unavailable in the local markets could undermine the success of an IVP intervention post-project implementation. Seed, spare parts, and repair services are often unavailable in local markets. Furthermore, in emergencies, the disruption of the local supply chains can further inflate the cost of IVP interventions.

Irrigation Intervention

Transferring technologies often follows a linear dissemination model, focusing solely on transferring equipment, input, and knowledge during the short duration of the intervention. Often, farmers do not have the means to maintain, upgrade, and buy inputs, spare parts, or other complementary technologies after an intervention is over. Furthermore, during emergencies, these networks can be severely disrupted. Paying insufficient attention to the potential effects of future emergencies on IVP interventions can negatively impact livelihood and nutritional outcomes.

Overreliance on limited government data and minimal engagement with other forms of knowledge circumscribes organizations' ability to support sustainable management of water resources. A glaring omission in many interventions is the lack of consultation with indigenous knowledge systems during beneficiary targeting and assessment of water resources. This may overlook insights that quantitative data alone cannot capture. Conflicts among users of water resources, especially where such resources are scarce, can exacerbate the difficulties in ensuring sustained water access for irrigation.

Implementation and Partnerships

Limited reflective and collaborative learning among humanitarian organizations inhibits IVP intervention design and implementation improvement. Most organizations do not carry out impact evaluation after completing a project. This limits learning within and between organizations about what works and what does not. There is also limited use of secondary data, resulting in missed opportunities for cumulative learning and collaboration to leverage synergies.

The lack of systemic analysis in designing IVP interventions results in myopic design. Most organizations focus only on household- and community-level indicators. There is limited analysis of irrigation practices, value chains, food production, and the enabling environment. This could have unintended consequences if too many farmers start producing the same vegetables simultaneously and as a result market prices decline.

In summary, IVP interventions adopt different strategies in seed distribution, training models, irrigation support, and partnerships. The impact of interventions can be both positive and negative. IVP interventions benefit households economically through income obtained by selling the harvest, and nutritionally through home consumption. Some beneficiary communities opt to sell vegetables for income, leading to low household consumption. Beneficiaries may also not be aware of the nutritional value of new vegetable crops. When prioritizing IVP over other pathways of livelihood diversification, it is essential to reflect on which intervention may limit engagement in others and which are more sustainable livelihood strategies.

Recommendations

This analysis of the challenges and opportunities influencing IVP interventions highlights several ways to achieve the overarching goals of such interventions. These overarching goals include supporting diversified livelihood opportunities and new sources of income, and improving nutritional outcomes, particularly for women and children. They can be achieved by increasing the resilience of vulnerable households and communities affected by crises. To reach this vision, humanitarian IVP interventions should aim to:

1. Targeting Beneficiaries and Selecting Agriculture-Based Interventions;
2. Ensuring Contextually Relevant IVP Intervention Design, Planning, and Implementation;
3. Strengthening Organizational Capacity for Humanitarian Emergency Assistance;
4. Mobilizing Resources and Investments to Complement the Funding Shortage; and
5. Improving Learning Through Data and Knowledge Management.

The following recommendations are aligned with the SEADS standards. The first two contribute to the section on "Tools, equipment, and other non-seed inputs." They highlight considerations that are relevant to IVP interventions and link to the section's five minimum standards: assessment and planning, identifying technical options and timing, market-based services and systems support, choice of tools, equipment, and other non-seed inputs, and input quality. The final two recommendations contribute to the "Impact-oriented monitoring and evaluation" section and link to minimum standards of participatory approaches, project objectives, process monitoring and indicators, impact indicators, participatory end-of-project review, and participatory impact evaluation.

1. Targeting Beneficiaries and Selecting Agriculture-Based Interventions

The focus of this recommendation is on selecting the right beneficiaries and determining whether the IVP interventions are relevant to the emergency context and to communities most vulnerable to it. It is linked to the SEADS minimum standard of initial assessment for crop-related crisis response and choice of tools, equipment, and other non-seed inputs. The following recommendations are suggested for ***humanitarian organizations:***

- **Beneficiaries should be selected based on dynamic vulnerabilities, and target individuals and households that would benefit most from IVP.** As beneficiaries often prioritize other needs above certain aspects of food security, humanitarian organizations should exercise discernment in selecting beneficiaries capable of sustaining project outcomes.

- **Triangulating government data with information from other reliable sources is necessary to improve beneficiary targeting.** The selection should not purely be based on government data, especially as the types of vulnerability that households experience may vary significantly depending on the type of disaster.

- **To be relevant to the targeted beneficiaries, the intervention should consider multiple dimensions of how people choose their livelihood strategies and whether the current emergency context has changed their desired livelihood outcomes.** These dimensions include but are not limited to:

    - Beneficiaries' needs, preferences, and long-term livelihood opportunities: The perceived needs of the affected population, organizational knowledge and capacity to meet those needs, and logistical and technical constraints in the organization and the enabling environment.
    - Emergency context: Effect of the emergency on prices, types of producers most in need of assistance, the ability of a community to participate in selecting beneficiaries, and the creation of new vulnerabilities.
    - Sustainability and inclusivity of the IVP intervention: Water and land resources, seed markets, availability of irrigation technologies and equipment, input and output markets.

- **The intervention should be informed by insights into irrigation equipment supply chains, irrigated vegetable value chains, and markets.** This helps to identify potential intervention areas, existing resources and supports, potential partners, and the ways to mobilize resources and improve the systemic resilience of value chains to mitigate the impact of future crises.

- **Consulting with and engaging vulnerable communities in selecting IVP interventions is critical to achieve greater impact.** Avoiding the perceived abstract need to "diversify" livelihoods and agricultural production as the primary indication for IVP interventions is essential.

2. Ensuring Contextually Relevant IVP Intervention Design, Planning, and Implementation

The focus is on improving the relevance and best fit of IVP interventions to the emergency context and vulnerable communities. This is linked to the SEADS minimum standard of choice of tools, equipment, and other non-seed inputs. The following recommendations are suggested for ***humanitarian organizations:***

For designing and implementing IVP interventions:

- **The IVP intervention design should be based on a comprehensive understanding of how the emergency context affects food, land, and water systems.** Identifying and addressing potential trade-offs is necessary to anticipate how the intervention may impact other food, land, and water systems, and how those impacts might affect other members of the community/communities. This allows for tailoring interventions attuned to whether the emergency induces system dysfunction or whether system dysfunction was a chronic issue before the emergency.

- **Analyze dynamic vulnerabilities to compare the costs and benefits of commercial production as compared to subsistence production within the specific emergency context.** Rapid risk assessment is necessary to identify and mitigate the unintended consequences of IVP interventions. Weighing the costs and benefits of promoting either commercial or subsistence IVP is necessary to avoid negative consequences. This will help humanitarian organizations select and improve existing production methods for vegetables that are already cultivated and in high demand or promote new vegetable varieties instead.

- **Strengthening linkages among actors, especially between local agro-dealers and seed companies in cities, can sustain seed access.** Local agro-dealers can inform city-based dealers about demand for vegetable seed and organize seed access. Supporting local seed multiplication and saving can be a great strategy to make seeds available. Some farmers save seeds for use in the next season, which presents an opportunity to scale up such innovations. However, for this to be successful, the distributed seeds must be of good enough quality to be used for multiple seasons. Collaboration between seed producers and research institutions is key to supporting the production and multiplication of quality seed.

- **Irrigation should be designed and planned as a commercial endeavor involving higher-cost technologies such as diesel, drip, or solar systems.** It requires a differentiation between high-cost and low-cost technologies, factoring in financial costs and maintenance and labor requirements. Irrigation technologies should be chosen based on beneficiaries' preferences and whether the main objective is subsistence or commercial IVP. For subsistence production, the technologies should be straightforward, easier to maintain, and more readily available in local markets than technologies for commercial production.

- **It is necessary to adapt intervention activities to changes in the vulnerable communities' emergency context, trade-offs, and emerging demands.** Additional activities would include enhancing farmers' access to the value chain, establishing stronger linkages to existing innovation systems, and involving and increasing capacities along the value chains to engage with more vulnerable households. Engaging beneficiaries, actors, and stakeholders helps to adapt the intervention to needs and contextual changes to sustain post-emergency investments.

For gender inclusion in the IVP interventions:

- **Gendered preferences for irrigated crops and technology choices must be central to IVP design.** While gendered constraints to technology access are important, focusing solely on those constraints treats technology acquisition as the end goal. Reducing the burden on women when promoting irrigation requires addressing household structure and intra-household dynamics and incorrect assumptions about who controls and benefits from the technologies.

- **The decision whether to support commercial production or subsistence production should be based on thoughtful consideration of the implications for gender dynamics at the household and community levels.** Specifically, IVP interventions which target increasing household nutrition, and women's empowerment should prioritize leafy or other vegetables that can be sold in smaller quantities over an extended period, allowing women to retain control over their earnings.

3. Strengthening Organizational Capacity for Humanitarian Emergency Assistance

This focuses on developing the capacity of humanitarian organizations to deliver impactful emergency assistance while improving the ability of vulnerable communities to cope with escalating crises and mounting humanitarian needs. In designing and implementing interventions, organizations tend to draw from their experiences. So improved organizational capacity for long-term learning can provide a structure for documentation, dissemination, and learning in different emergency contexts. This is linked to the SEADS minimum standard of monitoring processes and indicators. Some suggested recommendations for ***donors and humanitarian organizations*** are:

- **Build capacity to conduct rapid needs analysis to be able to deliver greater impact.** This can be achieved by strengthening reflective and analytical skills within the organization to analyze and integrate results and insights into the design, planning, and implementation of IVP interventions. The ability to conduct a rapid assessment that distinguishes between pre-existing vulnerabilities and the long-term effects of rapid, slow or complex crises can guide the development of responsive, proactive, and sustainable interventions. Also important is the ability to analyze and manage risks and tradeoffs that emerge along the emergency assistance process.

- **Improve data collection and analysis capacity within the organization to justify the choice of IVP intervention and monitor its impact and effectiveness post program.** Unlike development programs conducted in a stable context, humanitarian responders often have much less administrative data to work with, a more mobile population to deal with, and much less time to identify beneficiaries most in need of assistance. They depend therefore in many cases on governmental data which often are outdated and not necessarily collected with humanitarian interventions in mind. The urgency to act quickly and the need to assess the potential impact of the intervention make for a difficult balancing act. Given such challenges, assumptions on the need for IVP interventions often go unsubstantiated.

- **Develop intra-organizational learning to improve IVP intervention design, proactiveness, and responsiveness to emergencies.** This requires gathering and analyzing data right along the intervention process because the effects of crises are highly context- and time-specific, and emergencies often precipitate livelihood shifts. It also calls for testing assumptions during intervention design (WorldVeg guidelines); and recognizing that decreasing vulnerability in one dimension may increase vulnerability in another.

- **Organizations need strong monitoring and evaluation systems and improved capacity to collect and analyze how household access to assets changes due to an intervention.** Market analysis and information dissemination can guide farmers on profitable crop cultivation and market access. Using a systems lens to understand the potential impacts of an intervention on long-term resilience outcomes is essential for establishing an accurate theory of change.

- **Develop organizational capacity to implement holistic IVP interventions that do not focus solely on engaging directly with vulnerable households but also on strengthening input, output, and technology markets together with relevant private sector institutions.** This requires partnering with private sector actors, including those involved in input and output markets, middlemen, traders, transport and storage facilities, irrigation repair and maintenance services, and spare parts businesses. This requires a capacity to continually build partnerships with on-the-ground actors to enable rapid response, including identification of suppliers, situation appraisal, and community consultation.

- **Cultivate the capacity to influence the enabling environment to enhance the longer-lasting outcomes of IVP interventions.** Formal and informal institutions may still function during emergencies (informal seed distribution networks, for example) and have certain strengths or capacities that can contribute to reducing

vulnerability or create new possibilities. Humanitarian organizations can build on such institutions as part of their interventions.

4. Mobilizing Resources and Investments to Complement the Funding Shortage

The focus here is on mobilizing resources and investments from the public and private sectors to bridge the gap in funding for humanitarian IVP interventions. This is linked to the SEADS minimum market-based services and system support standard. The following recommendations are suggested for ***donors and humanitarian organizations***:

- **Partner with private sector entities in irrigation supply chains and markets to leverage their investments while stabilizing and invigorating value chains and improving beneficiaries' access to markets.** These partnerships should prioritize bundling irrigation technologies and financial services to make irrigation bundles available and affordable for different beneficiaries and their communities.

- **Collaborate with research institutions to develop appropriate innovations for IVP interventions.** This involves exploring wastewater management and potential treatment and use of gray water for irrigation where water scarcity is often an issue; designing smart IVP systems for landless people who do not have secure land tenure, such as sack gardening; and cultivating irrigation systems and culture for refugee communities or displaced people that have yet to engage in IVP.

- **Partner with government agencies to build on the existing infrastructure and support from the government.** This is especially necessary for organizations with limited funds and resources, and short project timelines. Leveraging the support of governmental bodies is essential for formulating and implementing policies and legislation aimed at improving market access and functionality. Such measures could include tax breaks, subsidies, and other financial incentives.

- **Invest in inclusive financial mechanisms and ecosystems for humanitarian emergency assistance.** This requires, first, an assessment of the financing sector, market presence, infrastructure, and production patterns in the region to identify bottlenecks before, during, and after conflict. This also requires investment from donors and the government to tackle the inadequate financial support available for humanitarian emergency assistance, disparity regions, and vulnerable communities. While microfinance institutions do offer some level of funding, their loans are often modest and accompanied by high interest rates. Traditional banks, which could provide more substantial loans, are largely absent, primarily due to collateral requirements that small farmers find challenging to meet. In this context, responsive financing systems are required to support vulnerable households.

5. Improving Learning Through Data and Knowledge Management

This point focuses on building knowledge systems and promoting an interactive learning culture to ensure impactful IVP interventions through joint efforts, collaboration, coordination, and cost-efficiency. It is linked to the SEADS minimum standard of participatory approaches. Some suggested recommendations for ***the government, donors, and humanitarian organizations*** are:

- **Integrate data from multiple sources into a single platform for improved humanitarian emergency assistance.** The government should explore developing/using/contributing to data gathering from academic research, government records, and UN agencies. Data on vulnerable households, livelihood strategies, water resources, markets, and value chains may be relevant. Secondary information produced by academics, government, or humanitarian organizations should be used and leveraged to minimize costs. Best practices, case studies, and research findings can be collated and disseminated to policymakers, practitioners, and researchers, providing evidence-based insights to inform future interventions. The repository should be designed to be easily accessible and should be updated regularly to reflect emerging trends and findings.

- **Ensure quick and easy access to data platforms for better design and planning of IVP interventions.** This includes stimulating data sharing on nationwide water resource availability, management, and use.

Segmented and dispersed data on water resources held by different actors, including private sector entities, should be made available.

- **An internal database should be created for collecting and analyzing information, especially on less common crises** (e.g., the COVID-19 pandemic). Humanitarian organizations can work with the government to understand what institutions make up the IVP value chain, which populations they serve, and how they can be supported. Stakeholders and actors in the humanitarian emergency assistance ecosystem should be mapped to identify existing intelligence.

- **Establish robust reporting systems to record the reasoning behind intervention design, decisions made during implementation, and postevaluation learnings.** Donors can mandate documentation for selecting specific irrigation technologies or practices and stimulate the sharing of water resource data among humanitarian organizations. Such requirements could significantly aid in compiling a database on effective practices, contributing to more informed and sustainable interventions.

- **Form a community of practice with partners and organizations with expertise in IVP in Ethiopia.** Such a community of practice could serve as a mechanism for knowledge sharing, capacity building, research collaboration, and policy alignment. Establishing a clear agenda focused on the specific challenges and opportunities related to IVP in an emergency setting is crucial. The CoP should actively engage with existing policies and governance structures to identify gaps and opportunities for policy intervention.

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The International Water Management Institute (IWMI) is an international, research-for-development organization that works with governments, civil society and the private sector to solve water problems in developing countries and scale up solutions. Through partnership, IWMI combines research on the sustainable use of water and land resources, knowledge services and products with capacity strengthening, dialogue and policy analysis to support implementation of water management solutions for agriculture, ecosystems, climate change and inclusive economic growth. Headquartered in Colombo, Sri Lanka, IWMI is a CGIAR Research Center with offices in 15 countries and a global network of scientists operating in more than 55 countries.

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